What is claimed is:

1. An area separating apparatus for judging whether or not each object pixel belongs to a photograph image area in an image on the basis of image data indicative of density gradation levels of pixels constituting the image, the apparatus comprising:

an average value calculating circuit for calculating an average value of image data of pixels in a first image block of a predetermined size containing the object pixel;

a photograph image area judgment threshold generating circuit for generating a photograph image area judgment threshold in accordance with the average value calculated by the average value calculating circuit;

a density difference summing circuit for determining differences in image data between respective adjacent pairs of pixels in the image block and calculating a sum of the image data differences for all the pixels in the image block; and

a first judgment circuit which judges that the object pixel belongs to the photograph image area if the sum of the image data differences calculated by the density difference summing circuit is smaller than the photograph image area judgment threshold generated by the photograph image area judgment threshold generating circuit, and

judges that the object pixel does not belong to the photograph image area if the sum of the image data differences is not smaller than the photograph image area judgment threshold.

2. An area separating apparatus as set forth in claim 1, further comprising:

a first direction density difference summing circuit for determining differences in image data between respective adjacent pairs of pixels aligning in a first direction in a second image block of a predetermined size containing the object pixel and summing the image data differences for all the pixels in the second image block for determination of a first direction density difference sum;

a second direction density difference summing circuit for determining differences in image data between respective adjacent pairs of pixels aligning in a second direction different from the first direction in the second image block and summing the image data differences for all the pixels in the second image block for determination of a second direction density difference sum;

a second judgment circuit for judging whether or not the object pixel belongs to a thin line image area on the basis of a magnitude relationship between the first direction density difference sum and the second direction

density difference sum respectively calculated by the first direction density difference summing circuit and the second direction density difference summing circuit; and

a re-judgment circuit which re-judges that the object pixel belongs to the photograph image area if the object pixel is judged to belong to the photograph image area by the first judgment circuit and is judged not to belong to the thin line image area by the second judgment circuit, and re-judges that the object pixel does not belong to the photograph image area if the object pixel is judged to belong to the photograph image area by the first judgment circuit and is judged to belong to the thin line image area by the second judgment circuit.

3. An area separating apparatus as set forth in claim 2, wherein the second judgment circuit compares the first direction density difference sum calculated by the first direction density difference summing circuit and the second direction density difference sum calculated by the second direction density difference summing circuit with a pair of first direction judgment thresholds HL, HH (HL<HH) and a pair of second direction judgment thresholds VL, VH (VL<VH), respectively, and judges that the object pixel belongs to the thin line image area if a condition that the first direction density difference

sum is not smaller than the first direction judgment threshold HH and the second direction density difference sum is not greater than the second direction judgment threshold VL is satisfied, or if a condition that the first direction density difference sum is not greater than the first direction judgment threshold HL and the second direction density difference sum is not smaller than the second direction judgment threshold VH is satisfied, and judges that the object pixel does not belong to the thin line image area if neither of the conditions is satisfied.

4. An area separating apparatus as set forth in claim 1, further comprising:

an integrator circuit for performing an integration process on image data of the object pixel with the use of the image data of the object pixel and image data of peripheral pixels around the object pixel,

wherein a judgment is made on the basis of the image data pre-processed by the integrator circuit to determine which of the image areas the object pixel belongs to.

5. An area separating apparatus as set forth in claim 1, wherein the image data is subjected to a halftoning process, which includes a dotting process to be performed on the basis of a predetermined line frequency on pixels judged to belong to the photograph image area, the area

separating apparatus further comprising a pre-judgment circuit for performing a pre-judgment process to define a boundary line frequency between the predetermined line frequency and the predetermined line frequency plus 50 lpi and exclude pixels constituting a halftone dot image with a line frequency lower than the boundary line frequency from the pixels judged to belong to the photograph image area.

6. An area separating apparatus as set forth in claim 5, wherein the pre-judgment circuit performs the pre-judgment process on the image data to be subjected to the halftoning process.

7. An area separating apparatus as set forth in claim 5, wherein the pre-judgment circuit includes an integration filter for performing a smoothing process on the image data so as to cause halftone dots constituting a halftone dot image with a line frequency not lower than the boundary line frequency to contact one another.

8. An area separating apparatus for judging whether or not each object pixel belongs to a thin line image area in an image on the basis of image data indicative of density gradation levels of pixels constituting the image, the apparatus comprising:

a first direction density difference summing circuit for determining differences in image data between

respective adjacent pairs of pixels aligning in a first direction in a second image block of a predetermined size containing the object pixel and summing the image data differences for all the pixels in the second image block for determination of a first direction density difference sum;

a second direction density difference summing circuit for determining differences in image data between respective adjacent pairs of pixels aligning in a second direction different from the first direction in the second image block and summing the image data differences for all the pixels in the second image block for determination of a second direction density difference sum; and

a second judgment circuit for judging whether or not the object pixel belongs to the thin line image area on the basis of a magnitude relationship between the first direction density difference sum and the second direction density difference sum respectively calculated by the first direction density difference summing circuit and the second direction density difference summing circuit.

9. An image processing apparatus for processing image data indicative of density gradation levels of pixels constituting an image in accordance with a judgment on whether or not each object pixel belongs to a photograph image area in the image, the apparatus comprising:

an average value calculating circuit for calculating an average value of image data of pixels in a first image block of a predetermined size containing the object pixel;

a photograph image area judgment threshold generating circuit for generating a photograph image area judgment threshold in accordance with the average value calculated by the average value calculating circuit;

a density difference summing circuit for determining differences in image data between respective adjacent pairs of pixels in the image block and calculating a sum of the image data differences for all the pixels in the image block;

a first judgment circuit which judges that the object pixel belongs to the photograph image area if the sum of the image data differences calculated by the density difference summing circuit is smaller than the photograph image area judgment threshold generated by the photograph image area judgment threshold generating circuit, and judges that the object pixel does not belong to the photograph image area if the sum of the image data differences is not smaller than the photograph image area judgment threshold; and

a halftoning circuit for performing a dot concentration halftoning process on pixels judged to

belong to the photograph image area and performing a dot distribution halftoning process on pixels judged not to belong to the photograph image area.

10. An image processing apparatus as set forth in claim 9, further comprising:

a first direction density difference summing circuit for determining differences in image data between respective adjacent pairs of pixels aligning in a first direction in a second image block of a predetermined size containing the object pixel and summing the image data differences for all the pixels in the second image block for determination of a first direction density difference sum;

a second direction density difference summing circuit for determining differences in image data between respective adjacent pairs of pixels aligning in a second direction different from the first direction in the second image block and summing the image data differences for all the pixels in the second image block for determination of a second direction density difference sum;

a second judgment circuit for judging whether or not the object pixel belongs to a thin line image area on the basis of a magnitude relationship between the first direction density difference sum and the second direction density difference sum respectively calculated by the

first direction density difference summing circuit and the second direction density difference summing circuit; and

a re-judgment circuit which re-judges that the object pixel belongs to the photograph image area if the object pixel is judged to belong to the photograph image area by the first judgment circuit and is judged not to belong to the thin line image area by the second judgment circuit, and re-judges that the object pixel does not belong to the photograph image area if the object pixel is judged to belong to the photograph image area by the first judgment circuit and is judged to belong to the thin line image area by the second judgment circuit.

11. An area separating method for judging whether or not each object pixel belongs to a photograph image area in an image on the basis of image data indicative of density gradation levels of pixels constituting the image, the method comprising the steps of:

calculating an average value of image data of pixels in a first image block of a predetermined size containing the object pixel;

determining differences in image data between respective adjacent pairs of pixels in the image block and calculating a sum of the image data differences for all the pixels in the image block; and

performing a first judgment process to judge that the object pixel belongs to the photograph image area if the sum of the image data differences is smaller than a photograph image area judgment threshold determined in accordance with the average value, and to judge that the object pixel does not belong to the photograph image area if the sum of the image data differences is not smaller than the photograph image area judgment threshold.

12. An area separating method as set forth in claim 11, further comprising the steps of:

determining differences in image data between respective adjacent pairs of pixels aligning in a first direction in a second image block of a predetermined size containing the object pixel and summing the image data differences for all the pixels in the second image block for determination of a first direction density difference sum;

determining differences in image data between respective adjacent pairs of pixels aligning in a second direction different from the first direction in the second image block and summing the image data differences for all the pixels in the second image block for determination of a second direction density difference sum;

performing a second judgment process to judge whether or not the object pixel belongs to a thin line

image area on the basis of a magnitude relationship between the first direction density difference sum and the second direction density difference sum; and

re-judging that the object pixel belongs to the photograph image area if the object pixel is judged to belong to the photograph image area in the first judgment step and is judged not to belong to the thin line image area in the second judgment step, and re-judging that the object pixel does not belong to the photograph image area if the object pixel is judged to belong to the photograph image area in the first judgment step and is judged to belong to the thin line image area in the second judgment step.

13. An area separating method as set forth in claim 12, wherein the second judgment step comprises the steps of:

comparing the first direction density difference sum and the second direction density difference sum with a pair of first direction judgment thresholds HL, HH (HL<HH) and a pair of second direction judgment thresholds VL, VH (VL<VH), respectively; and

judging that the object pixel belongs to the thin line image area if a condition that the first direction density difference sum is not smaller than the first direction judgment threshold HH and the second direction

density difference sum is not greater than the second direction judgment threshold VL is satisfied, or if a condition that the first direction density difference sum is not greater than the first direction judgment threshold HL and the second direction density difference sum is not smaller than the second direction judgment threshold VH is satisfied, and judging that the object pixel does not belong to the thin line image area if neither of the conditions is satisfied.

14. An area separating method as set forth in claim 11, further comprising the step of:

performing an integration process on image data of the object pixel with the use of the image data of the object pixel and image data of peripheral pixels around the object pixel,

wherein a judgment is made on the basis of the image data pre-processed in the integration step to determine which of the image areas the object pixel belongs to.

15. An area separating method as set forth in claim 11, wherein the image data is subjected to a halftoning process, which includes a dotting process to be performed on the basis of a predetermined line frequency on pixels judged to belong to the photograph image area, the area separating method further comprising the step of performing a pre-judgment process to define a boundary

line frequency between the predetermined line frequency and the predetermined line frequency plus 50 lpi and exclude pixels constituting a halftone dot image with a line frequency lower than the boundary line frequency from the pixels judged to belong to the photograph image area.

16. An area separating method as set forth in claim 15, wherein the pre-judgment process is performed on the image data to be subjected to the halftoning process in the pre-judgment step.

17. An area separating method as set forth in claim 15, wherein the pre-judgment step comprises the step of performing a smoothing process on the image data so as to cause halftone dots constituting a halftone dot image with a line frequency not lower than the boundary line frequency to contact one another.

18. An area separating method for judging whether or not each object pixel belongs to a thin line image area in an image on the basis of image data indicative of density gradation levels of pixels constituting the image, the method comprising the steps of:

determining differences in image data between respective adjacent pairs of pixels aligning in a first direction in a second image block of a predetermined size containing the object pixel and summing the image data

differences for all the pixels in the second image block for determination of a first direction density difference sum;

determining differences in image data between respective adjacent pairs of pixels aligning in a second direction different from the first direction in the second image block and summing the image data differences for all the pixels in the second image block for determination of a second direction density difference sum; and

performing a second judgment process to judge whether or not the object pixel belongs to the thin line image area on the basis of a magnitude relationship between the first direction density difference sum and the second direction density difference sum.